Unit 5: Principles and Applications of Biology II

Delivery guidance

Approaching the unit

In this unit, learners will explore biological molecules and their relevance to diseases, disorders, treatments and therapies. There are some opportunities to undertake practical work, particularly in learning aim A, but there is no formal assessment of practical work in the unit.

Learners will need to understand the structure and role of biological molecules in body processes and pathways. This will lead them to carry out research to gain an understanding of how disruption to the molecules and/or systems and pathways can lead to physiological and psychological disorders or diseases.

Current treatments and the development of innovative and future types of treatments will be examined.

Learners will need to be encouraged to 'read around' the subject, and they must access a range of secondary source materials. These should not be limited to textbooks but should include the internet and scientific and popular science journals to ensure up-to-date information is used. The sources they have accessed must be referenced.

Sensitivity and empathy will be required during the delivery of this unit as some learners may have personal experiences of some of the diseases/disorders in the unit.

It is strongly recommended that learners are encouraged to gain an understanding of the diseases/disorders covered in the unit through a case study approach. This could be a video, blog or written piece of work. Learners should be encouraged to use a person known to them as a basis of the case study they produce, and will need support and guidance during teaching and learning about constructing case studies. Visits from health professionals or representatives of charities and organisations working on behalf of diseases/disorders should be considered. This will require careful coordination and timing to fit into the delivery schedule.

Personal associations with physiological and psychological disorders mean the content for these learning aims will need to be dealt with sensitively. Ground rules may need to be established to prevent offence or distress to learners. This is an important part of developing vocational behaviours. Complementary and alternative therapies may be of particular interest to some learners. Visits from practitioners will be useful in providing a vocational context and to allow learners to understand vocational behaviour. It will also help develop questioning techniques.

There is overlap of the physiological diseases studied in learning aims A and B. This may lead to a decision to spend time looking at these diseases and their treatments in depth before assessing learning aim A. This would reduce the time needed for research into the treatments for physiological diseases for learning aim B.

Small group work and presentation of findings is recommended. This will develop transferable skills, research and communication skills. Randomly selecting pairs/groups will help develop interpersonal and intrapersonal skills.

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Delivering the learning aims

A range of delivery methods to engage all types of learners and learning styles can be used, for example:

- discussions, both as a class and in small groups, relating to research and developments of preventative and corrective treatments
- model-making to embed an understanding of specific response mechanisms to disease
- presentations of facts and information that individuals or small groups have researched, which can be presented to the rest of the class
- visits to or from staff involved in pharmaceutical development and/or delivery of treatments.

As with all internally assessed units, all the unit content is mandatory and must be delivered during teaching and learning.

The evidence for assessment need not cover every aspect of the unit content as learners will normally use particular examples, case studies or contexts for their assignments. Learners have the opportunity to choose a variety of diseases and disorders, and the development of treatments that are of interest to them when completing their work for assessment.

Centres should ensure that delivery of content is kept up to date, particularly where reference to regulation, legislation, policies and regulatory/standards organisations are part of the assessment requirements.

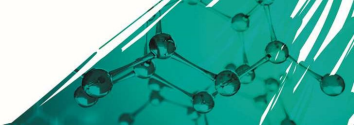
For **learning aim A**, learners will build on their knowledge of *Unit 1: Principles and Applications of Biology I* and the importance of the structure and function of biological molecules. This will be extended to include their role in maintaining physiological and psychological health.

You will need to allow learners to consider each of the groups of biological molecules mentioned in learning aim A in terms of how each functions in body systems and pathways to maintain a healthy state. This subject matter is very detailed and can be covered by a mixture of research, class discussions, problem-solving (such as matching a series of cards with functions written on them to the correct molecule) and the use of concept map diagrams to show how their functions interact or in other cases are very specific.

Familiarity with the 3D structure of the molecules and their functions at a molecular level within living organisms can be consolidated by the use of molecular models and other visual representations, such as computer-generated models. This will be very important in the case of proteins, where your learners may find the structures difficult to visualise. Understanding these structures is vital if your learners are to fully explain, discuss and evaluate the impact of structural disruption to the molecules and the effect this can have on physiological and psychological health.

Learning aim B requires an understanding of treatments and therapies for physiological disorders. Their positive and negative effects must be considered. All the unit content must be delivered but only issues relevant to the disease/disorders chosen by the learner will need to be evidenced for assessment. It is important to ensure that the diseases chosen will allow learners to demonstrate breadth and depth of the unit content. Learners could be encouraged to work in pairs to choose diseases to research and present their findings to the rest of the class. This will help develop transferable and interpersonal skills. Many learners may be familiar with at least one disorder/disease in the unit content and may want to research this further. For assessment, two diseases/disorders from the categories in the unit content must be studied.

For **learning aim C**, learners are unlikely to be familiar with the development and innovation of drugs, clinical trials and the range of different treatments that are available and in developmental stages. They will need considerable support and guidance to understand and be able to briefly describe the process and procedures that need to be followed. Learners will need to be encouraged to define and consider the differences between moral, ethical and legal issues relating to testing of drugs and



treatments. Media reports of breakthroughs in drug development, therapies and treatments will give stimuli for debate and discussion about what can and should be done. Learners will need to be supported to understand the process of drug development and the reasons for the complexity of testing. Learners should be encouraged to debate the ethical, legal and moral issues. 'Ground rules' about respect for the opinions of other people will need to be established and enforced.

Assessment model

Learning aim	Key content areas	Recommended assessment approach
A Understand molecules and pathways and their effect on the body	**A1** Structure and function of biological molecules **A2** Roles of proteins and lipids in maintaining physiological and psychological health **A3** Disruption of biological processes in living organisms	A report on biological molecules and how their structure affects their role, and how structural disruption can lead to physiological and psychological diseases and disorders.
B Understand the effects of physiological diseases and disorders and associated treatments	**B1** Physiological diseases and disorders **B2** Treatments for physiological diseases and disorders **B3** Effects on the body	A portfolio of evidence detailing the causes, effects and treatments used for physiological disorders.
C Examine the development of innovative and future types of treatment for physiological and psychological diseases and disorders	**C1** Drug and medicine discovery and development **C2** Innovative treatments **C3** Ethical, legal and moral issues	report on the development and esting of drugs and medicines and ssociated ethical, moral and legal sues relating to treatments of hysiological and psychological iseases.

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Assessment guidance

This is a mandatory, internally set and assessed unit for the Foundation Diploma, Diploma and Extended Diploma programmes. It consists of three learning aims. There is a maximum of three summative assessments – one for each learning aim. Authorised assignment briefs are available for the unit and demonstrate the holistic, distinction-first approach that is required to encourage learners to access all criteria.

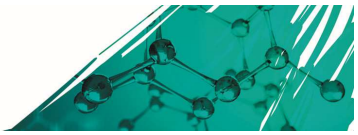
Learners must give independent, valid and authentic evidence to meet the assessment criteria. To facilitate this, learners should have an individual focus for their research. It is not good practice for all learners to submit evidence on the same disorder. Evidence for assessment does not have to be restricted to disorders listed in the unit content. The research and evidence may be the result of personal interest/connection to a disorder(s). Work for assessment must be different to that produced as part of teaching and learning.

The format of evidence to be submitted can be changed to cater for individual learner preferences. If presentations are to be used, consideration can be given to video/audio recording of the presentation.

For learning aim A, you will need to supply learners with information/ resources before they begin their research. They will need to be reminded about molecular structures and how to represent them visually. Once you are sure about their understanding of the structure, your learners can then begin their research on the functions of the molecules. Encourage your learners to present their work in a visual way, using annotated diagrams and the accepted notation for representing molecular structures. Learners need to explain, discuss and evaluate the importance of biological molecules in maintaining health and the impact of disruption for one physiological and one psychological disease/disorder. All learners should choose a disease/disorder of interest to them. They should not all be using the same ones.

For learning aim B, learners must explain, analyse and evaluate the effects of two physiological diseases or disorders in terms of the biological molecules involved in causing the disruption. The effects of associated treatments must be analysed and evaluated. Learners need to be aware of both positive and negative effects and the need to consider both when treatments are being decided. To help ensure validity and authenticity, all learners should choose a disease/disorder of interest to them. They should not all be using the same ones.

For learning aim C, the development of innovative and future types of treatments for physiological and psychological diseases and disorders must be examined. Learners must describe drug development and testing and problems associated with the testing of drugs. The development of a drug or medicine derived from a plant or animal and the development of a synthetic drug or medicine must be described. Testing and treatments must be considered in the context of ethical, moral and legal issues.



Getting started

This gives you a starting place for one way of delivering the unit, based around the recommended assessment approach in the specification.

Unit 5: Principles and Applications of Biology II

Introduction

This unit allows learners to understand the structure and function of biological molecules and how these affect their role in maintaining health.

Make learners aware that they will need to consider causes, effects and treatments of a wide variety of physiological and psychological diseases/disorders. This may prove challenging, and will require empathy and consideration of the feelings of others.

Transferable skills like communication, teamwork, research and analysis will be developed, along with appropriate vocational behaviours, which will be essential for working in the health sector.

While teaching and learning for each learning aim must occur prior to assessment of that learning aim commencing, due to the overlapping nature of learning aims A and B, assessors may wish to consider delivering an overview of the unit content for these two learning aims together. An in-depth period of teaching and learning could then be scheduled for each learning aim, prior to assessment of each learning aim.

Learning aim A – Understand molecules and pathways and their effect on the body

A1 & A2

- Give an introduction/presentation with an overview of the structure and function of biological molecules, the importance of proteins, nucleic acids and lipids in maintaining physiological health, and the disruption of biological processes in living organisms. Give handouts to learners covering key elements of the learning aim, key terms and annotated diagrams where useful.
- Hold a quiz/survey about the biological structure and function of proteins, nucleic acids and lipids to identify gaps and misunderstandings that need to be addressed.

A3

- Demonstrate model-making using Molymod or similar molecular modelling kits that can be purchased, or by using everyday items such as pipe cleaners, cocktail sticks and sweets, to show the importance of structure and bonding, and how shape and function are related and can cause disruption to biological processes. Different pairs/small groups could do this in relation to a protein, hormone, antibody, neurotransmitter, enzyme and a section of DNA.
- Hold a discussion about the differences between disease and disorder.
- Ask learners to consider and attempt to define what is meant by a physiological disease/disorder and a psychological disease/disorder, and to give examples.
- Introduce the structure of the brain, using a model and/or diagrams.
- Discuss the functions of the different regions of the brain.
- Working individually or in pairs, learners should create a spider map of psychological disorders/diseases and their causes and treatments that are known/familiar to learners. Learners should share their spider diagrams with another pair. Share class results.

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- Use prepared microscope slides or photomicrographs to observe healthy and unhealthy tissues for physiological and psychological disorders.
- Have pairs or small group research the causes, effects and treatments of psychological diseases and disorders detailed in the unit content.
- Give a case study/PowerPoint presentation of causes and effects to the rest of the class. It is important to recognise that not all diseases/disorders can be cured. The impact on the ability of a patient to lead a normal life should be discussed and understood. Treatments appraised should include medication, psychotherapy and support in the community. The effects these treatments can have on the body must also be investigated and discussed.
- Have learners identify similarities and differences between treatments discuss these alongside effectiveness (or otherwise), using secondary data.
- Organise a visit to a care facility/rehabilitation centre or a Skype/Facetime 'meeting' with practitioners to allow learners to ask questions about the impact of the diseases/disorders on the health of the body.

Learning aim B – Understand the effects of physiological diseases and disorders and associated treatments

B1 & B2

- Pairs or small groups carry out research into the effects and treatments of the range of physiological diseases and disorders listed in the unit content (cancer, coronary heart disease, diabetes, gender diseases and disorders).
- Use a class discussion to determine the knowledge and understanding of complementary and alternative therapies, and their advantages and disadvantages. Visits from practitioners may be useful.
- Learners present their research results to the whole group. This could take the form of a role play, with one learner playing the role of the patient and the other the role of a health professional, discussing possible treatments and their positive and negative effects.
- Present on other treatments available such as radiotherapy, chemotherapy, hormone therapy, surgery, targeted biological therapy and immunotherapy, gene therapy and stem cell therapy. A group discussion and research activity should follow.

B3

- Ask learners to look at each of these therapy types/categories and research the effects they have on the body (positive and negative), along with any risks associated with them.

Learning aim C – Examine the development of innovative and future types of treatment for physiological and psychological diseases and disorders

C1

- Introduce the topic by watching a YouTube video of the development of a drug, followed by a discussion of the different developmental stages. Follow this with a discussion of where drugs come from and how they can be synthesised/altered.
- Give a brief presentation on where drugs and medicines come from, isolating compounds from nature and creating synthetic compounds.
- Consider the use of newspaper/scientific journal/media reports of possible new treatments for discussion.

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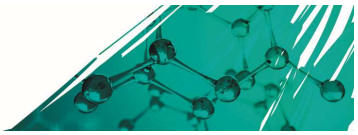

- Use stimulus material, e.g. newspaper reports/videos, about drug testing and how it can go wrong. Discuss why testing is necessary and why it can take a long time.

C2

- Use a learner research exercise to look at innovative and future treatments currently being developed or looked at, such as gene therapy, stem cell therapy and surgical techniques. They should research one treatment and present back to the group on what it is, where it is at in the developmental staging process, what it would treat, the ethical, legal or moral issues involved in the development process, and any known case studies of potential beneficiaries/trials.

C3

- Give a tutor-led discussion on ethical, legal and moral issues. Give case studies and high profile examples.
- Debate the ethics of drug testing, including use of animals versus humans and computer models.
- Use media reports like the controversy over availability and cost of new drugs and withdrawal of treatment.
- Discuss ethics, morality and legality of treating/not treating people. Other issues like separating conjoined twins (where one may not survive as a result of the separation) can be considered and discussed.
- Debate 'Do no harm' in relation to health professionals using current and future treatments.

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Details of links to other BTEC units and qualifications, and to other relevant units/qualifications

This unit links to:

- Unit 1: Principles and Applications of Biology I
- Unit 9: Biomedical Science
- Unit 11: Functional Physiology of Human Body Systems
- Unit 12: Human Regulation and Reproduction
- Unit 13: Biological Molecules and Metabolic Pathways
- Unit 15: Diseases and Infections.

Resources

In addition to the resources listed below, publishers are likely to produce Pearson-endorsed textbooks that support this unit of the BTEC International L3 Qualifications in Applied Science. Check the Pearson website (http://qualifications.pearson.com/endorsed-resources) for more information as titles achieve endorsement.

Textbooks

Waugh, A and Grant, A – *Ross & Wilson Anatomy and Physiology in Health and Illness* (Elsevier, 2018) 13th Edition, ISBN 9780702072765

Fullick, W – *Human Infectious Disease and Public Health* (OUP, 2019) 9780198814382

Any current A level textbook with a section on biological molecules, physiological and psychological diseases and disorders and the development of treatments for physiological and psychological diseases and disorders will provide suitable content to support learners.

Health and Social Care Level 3 textbooks may also contain useful information.

Journals

New Scientist

British Journal of Psychology

Articles from newspapers, television or radio transcripts or other scientific publications will be beneficial to aid the learning process.

Websites

Visit The Sunlight Experiment website and search '9 Famous Examples of Drugs That Came From Plants' for an introduction to some drugs that are obtained from plants.

Visit the Elsevier Scitech Connect website and search 'From Plant to Pill: How Do You Turn a Plant into Medicine?' for an introduction to how plants are turned into medicines.

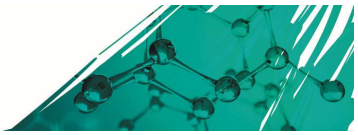
Visit the Cancer Quest website and search 'Drug development and discovery'.

Visit the World Health Organization website and search 'Mental disorders' for WHO fact sheets about mental disorders.

Visit the Psychology Today website and search 'Treatment of Psychological Diseases and Disorders'.

Visit the US Food & Drug Administration website, search 'The Drug Development Process', and go to 'Step 3: Clinical Research' for information about clinical research.

You can find many other sites using a search engine of your choice and typing in the subject required. These sites do tend to change, with new ones appearing and taking the place of existing ones. Always check the site is still active before recommending it to your learners.



Videos

On the NBC News website, search '3D Printed Molecule Models Solve Protein Puzzles' for an article and video about 3D printing of molecules.

Visit the Khan Academy website and search 'Elemental building blocks of biological molecules' for a video of model building of molecules.

Visit the PPDI website and search 'CRO Overview' for a video overview showing the process for creating life-changing drugs.

YouTube:

'Charlie Gard – Medical Ethics and Law'

'Where do our drugs come from?' - A short video introducing drugs obtained from organisms

'Collecting medicinal plants for drug research'

'Drug discovery and development process'

'When a Drug Trial goes Wrong: Emergency At The Hospital (Medical Documentary) |Real stories' – A documentary about clinical trials for TGN1412, a drug intended to treat leukaemia.

Pearson is not responsible for the content of any external internet sites. It is essential for tutors to preview each website before using it in class so as to ensure that the URL is still accurate, relevant and appropriate. We suggest that tutors bookmark useful websites and consider enabling students to access them through the school/college intranet.

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